REMARKS

This Amendment and Response is responsive to the Examiner's November 26, 2008 Office Action. Claims 1-4 and 21 are currently pending. Claims 1-4 stand rejected by the Examiner under 35 U.S.C. 103 as obvious in light of Dillon et al., Surface Science 322 (1995), 230-242 ("Dillon"), in view of Penneck et al., U.S. Pat. No. 4,985,313 ("Penneck").

New Claim 21, which depends from Claim 1, recites condensation of a portion of gaseous TMA in the reaction chamber on the substrate surface. Support for Claim 21 may be found in the Specification at, e.g., page 13. No new matter has been added.

As argued below, Dillon is a self-limited process that does not disclose, and is not compatible with, deposition of more than one monolayer of a film per cycle. Per-cycle film thickness, certainly thickness above a full monolayer, is not a variable of routine experiment or a result-effective variable where the goal of the process is deposition that is self-limited *to a monolayer*. Therefore, Dillon, alone or in combination with Penneck, fails to teach a cyclic process that includes formation of more than one monolayer of Al_2O_3 per cycle. Moreover, Dillon in view of Penneck fails to disclose condensation of precursor gas as recited in Claim 21 and fails to teach deposition at room temperature as recited in Claim 4.

Additionally, in light of the drawbacks of using oxygen plasma, including etching, one of skill in the art would not modify the precisely-controlled ALD process of Dillon to include the use of oxygen plasma as disclosed in Penneck unless there were a particular reason for doing so. No such reason has been provided, especially given that the process of Dillon is able to be performed successfully using other, less-corrosive reactants and does not require the use of a plasma generator.

For at least these reasons, and as explained more fully below, Applicant respectfully requests the rejections of Claims 1-4 be withdrawn and each of the pending claims be allowed.

Dillon's Process is Self-Limited

The Examiner requests evidence to show that the process of Dillon is self-limited and can only result in deposition of at most a monolayer per cycle. Applicant notes that Dillon ***itself*** repeatedly declares that the disclosed process is self-limited. *See, e.g., Dillon,* at abstract ("both the (A) and (B) reactions were ***self-limiting*** and complete"); *id.*, at 231 ("***self-limiting*** surface

reactions were observed..."); *id.*, at 238 ("spectra indicate that both reactions are complete and ***self-limiting***").

Dillon's process is self-limiting—as he himself repeatedly admits—because Dillon's process relies upon reactions of gaseous TMA and surface hydroxyls. As the gaseous TMA reacts with surface hydroxyls, the hydroxyls are "used up" in the **A** reaction. *See, e.g.*, *Dillon*, at Fig. 15 (showing depletion of hydroxyl surface species). Once all of the surface hydroxyls have been reacted, Dillon's **A** reaction ceases. Dillon's process allows for chemisorption of ***at most*** one molecule of TMA at any given point on the substrate because, once a molecule of TMA has been chemisorbed at a particular point, there are no more surface hydroxyls available at that point. *See id.*

Given that Dillon expressly discloses that the disclosed process is self-limited to no more than a single monolayer per cycle, and there is no evidence to suggest otherwise, Applicant suggests that additional evidence is unnecessary.

Applicant's Process is Distinct From Dillon

The Examiner states "though the applicant argues that the process of Dillon is self-limiting, Dillon discloses using the same precursor as the applicant, so if the use of this precursor was truly self-limiting, the 'more than one monolayer' limitation in claim 1 would be improper." Just because two processes use the same reactant does not mean that they will achieve the same result. Moreover, it is not the nature of the TMA precursor in Dillon that leads to the self-limiting nature of the reaction but rather the ***deposition conditions***. In Dillon, the deposition conditions are such that TMA adsorbs in a self-limiting manner. In contrast, in the claimed process, the deposition conditions are such that more than on monolayer of TMA forms on the substrate surface per cycle. These deposition conditions are necessarily different from those in Dillon. Thus, while Applicant's claimed process and Dillon's process both use TMA, the processes are different, and thus the same results would not be expected.

Applicant points out that, ***under the process conditions disclosed by Dillon, including*** the particular temperatures and pressures, TMA adsorbs on the substrate in a self-limiting manner and will not deposit more than one monolayer per cycle, as explicitly recognized by Dillon itself. Applicant, on the other hand, discloses and claims formation of more than one

monolayer of TMA on the substrate per cycle. This can be achieved by using ***different*** process conditions than those that are used in Dillon or typical ALD, namely those conditions that would cause more than one monolayer of TMA to form on the surface of the film Thus, Applicant's recital of deposition of more than one monolayer per cycle distinguishes Applicant's process from that of Dillon.

That being said, Claim 21 additionally recites a process wherein a portion of the gaseous TMA in the reaction chamber condenses on the substrate surface. Neither Dillon nor Penneck disclose condensation of a portion of the gaseous TMA, nor would one of skill in the art have a reason to attempt condensation of a precursor gas in a self-limiting ALD process.

Similarly, Claim 4 additionally recites carrying out the process of Claim 1 at room temperature. Dillon discloses ***annealing*** studies performed at room temperature, and Dillon performs an experimental ***non-cyclical*** chemisorption of TMA at 300K combined with a ***subsequent*** exposure at 500K, but Dillon does not disclose an **ABAB** reaction in which the **A** reaction (much less the entirety of the reaction) is performed at room temperature. In fact, if anything, Dillon implies that chemisorption of TMA at 300K is not useful in an **ABAB** process. *See* Dillon, at 232-33 (two consecutive 5-minute exposures of alumina membrane to TMA at 300K left broad absorbance of O-H stretching vibrations, indicating substantially incomplete reaction); *see also* id., at Fig. 2 (showing incomplete reaction at 300K and completion at 500K); id., at Fig. 3 (performing sequential exposures to TMA at 500K, but not at 300K); id., at 238 ("TMA reaction with a hydroxylated alumina surface does not go to completion at 300K"). No-where does Dillon disclose or suggest that an exposure to TMA at 300K is possible or useful in a sequential process.

Per-cycle Film Thickness is not a Result-Effective Variable

As discussed above, contrary to the Examiner's assertions, Dillon does not disclose variations in the per-cycle thickness of a deposited layer, and certainly does not disclose variation above a full monolayer as claimed. Dillon's disclosed reactions are each clearly self-limited to no more than a monolayer, and Dillon describes them as such.

Dillon expressly labels his process as "self limited." The Examiner has not pointed to any particular passage of Dillon that discloses variations in thickness above a monolayer. In fact,

the Examiner's sole support for this assertion is a general reference for Applicant to "see pages 239-241 et seq." Given that Dillon says nothing about either *thickness* or *multiple monolayers*, Applicant has asked the Examiner to identify with specificity which words or figures of "pages 239-241 et seq." that the Examiner finds to indicate that routine experimentation would lead to deposition of greater than one monolayer.

Applicant has thus been forced to guess at which parts of pages 239-241 et seq. the Examiner is referring to. Applicant has raised ***specific*** arguments as to why pages 239-241 do not disclose variations in film thickness per cycle above one monolayer. The Examiner has not directly addressed Applicant's arguments, has not explained why Applicant is mistaken, and has not provided an interpretation or identification of the relevant portions of Dillon. As Dillon is concerned with self-limited ALD reactions, non-self limited deposition, which would be required to achieve more than one monolayer, would simply not be a variation that would be attempted as it would change the very nature of Dillon's process.

Dillon's reactions are explicitly self-limited. The thickness of the deposited film in Dillon's process is not "a function of the time of substrate exposure to the precursor." As Dillon himself states, once the precursor exposure reaches saturation (meaning all surface hydroxyls have been removed), the TMA reaction is complete. No additional TMA would be chemisorbed given additional exposure once saturation is reached. Therefore, thickness above a single monolayer is not a variable of routine experimentation, or a result-effective variable.

Claims 1-4 and 21 Are Not Obvious in Light of Dillon in View of Penneck

As argued above, Dillon is a self-limiting process that does not disclose, and is not compatible with, deposition of more than one monolayer of resultant film. The Examiner's proposed modifications to Dillon improperly render Dillon unsatisfactory for its intended purpose, namely, precisely controlled, monolayer-by-monolayer deposition. See *In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984). Moreover, the Examiner's modifications improperly change the principle of operation of Dillon, namely, self-limited deposition by binary half-reaction of chemisorbed precursors. See *In re Ratti*, 270 F.2d 810 (CCPA 1959).

As Dillon is concerned with self-limited ALD reactions, non-self-limited deposition would not be an obvious variation that would be attempted as it would change the very nature of

Dillon's process. Per-cycle film thickness, certainly thickness above a full monolayer, is not a variable of routine experiment or a result-effective variable in the process of Dillon.

Therefore, Dillon, alone or in combination with Penneck, fails to teach a cyclic process that includes formation of more than one monolayer of Al_2O_3 per cycle. Moreover, as argued above, Dillon in view of Penneck fails to disclose condensation of precursor gas as recited in Claim 21 and fails to teach deposition at room temperature as recited in Claim 4.

Additionally, Applicant notes that oxygen plasma is highly corrosive and reactive and can cause etching in thin films. Given these drawbacks, one of skill in the art would not consider using plasma in a thin-film deposition process, especially in a precise deposition process such as ALD, without some particular reason to do so. Penneck is concerned with forming thick coatings on cables, so the use of plasma to speed the deposition process at the possible cost of some etching is plausible. Dillon, however, uses precisely controlled half-reactions to form conformal films one monolayer at a time. Given that the process of Dillon is successfully carried out using the reactants disclosed (*see, e.g.*, Dillon, at 238, Fig. 3), one of skill in the art would see no benefit to using corrosive oxygen plasma in Dillon unless there were some other particular reason to do so. No such reason has been supplied, so Dillon and Penneck would not be combined as suggested by the Examiner.

For at least these reasons, Applicant respectfully requests the rejections of Claims 1-4 be withdrawn. Applicant believes Claims 1-4 and 21 are in condition for allowance.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not

reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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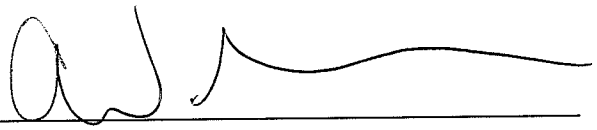
Dated: April 27, 2009

By: 

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